AD-A031 184 ARMY AVIATION TEST BOARD FORT RUCKER ALA F/G 21/5

MILITARY POTENTIAL TEST OF THE TURBINE-POWERED U-6 AIRPLANE.(U)

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B.S.

DEPARTMENT OF THE ARMY
UNITED STATES ARMY AVIATION TEST BOARD
Fort Rucker, Alabama 36362

STEBG-TD 9 6 13 SEP 1965

SUBJECT: Letter Report of Test, "Military Potential Test of the Turbine-Powered U-6 Airplane," USATECOM Project No. 4-5-1020-01 16

TO: See Distribution 11 13 Sep 65

12 54p.

1. Subject document, inclosure 1, is forwarded for information and retention.

2. A copy of the Headquarters, US Army Test and Evaluation Command, letter of approval is attached as inclosure 7.

2 Incl
as

Raymond E. Johnson
RAYMOND E. JOHNSON
Colonel, Artillery
President

DISTRIBUTION:
See page 2

J C Malloy
USAADTA (PROV)
14 Apr 76
AR 340-16

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DEPARTMENT OF THE ARMY
UNITED STATES ARMY AVIATION TEST BOARD
Fort Rucker, Alabama 36362

STEBG-TD 13 SEP 1965

SUBJECT: Military Potential Test of the Turbine-Powered U-6 Airplane, USATECOM Project No. 4-5-1020-01

TO: Commanding General
US Army Test and Evaluation Command
ATTN: AMSTE-BG
Aberdeen Proving Ground, Maryland 21005

1. References.

a. Department of the Army Technical Manual 55-1510-203-10, August 1963, subject: "Operator's Manual Army Model U-6A Aircraft."

b. Letter, Headquarters, Department of the Army, AGAM-P(M), 3 April 1964, subject: "US Army Aircraft Standard Avionics and Surveillance Configurations - Five Year Plan," with inclosures.

c. The DeHavilland Aircraft of Canada, Limited, Operating Manual, 1 December 1964, subject: "Turbo-Beaver Model DHC-2 MKIII Airplane Operating Data."

d. Letter, AMCRD-DF-A, Headquarters, US Army Materiel Command, 1 April 1965, subject: "Army Testing of the DeHavilland Canada DHC-2 MKIII Turbo-Beaver Aircraft."

e. Letter, BAAR-I, US Army Board for Aviation Accident Research, Fort Rucker, Alabama, 26 May 1965, subject: "Aviation Safety Evaluation of DeHavilland Turbo-Beaver Aircraft, USATECOM Project No. 4-5-1020-01."

2. Authority. Letter, AMSTE-BG, Headquarters, US Army Test and Evaluation Command, 23 April 1965, subject: "Test Directive for

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DC Mallory
USAADTA (PROV)
14 Apr 76
AR 340-16

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SUBJECT: Military Potential Test of the Turbine-Powered U-6 Airplane, USATECOM Project No. 4-5-1020-01

USATECOM Project No. 4-5-1020-01, -02, Military Potential Test of the Turbine-Powered U-6 Airplane."

3. Objectives.

a. Purpose. To determine the military potential of the DeHavilland Turbo-Beaver by comparison with the standard Army U-6 Airplane.

b. Objectives. To determine by comparison with the standard U-6 Airplane, the:

(1) Physical characteristics

(2) STOL characteristics

(3) Mission capability

(4) Climb capability

(5) Suitability of the aircraft configuration

(6) Transition requirements

(7) Ease of maintenance

(8) Operating cost

4. Background.

a. The U-6 aircraft manufacturer, in an effort to utilize the advantages of the turbine engine, modified a company-owned U-6 Airplane. The modification consisted principally of replacing the R-985 reciprocating engine with a T-74 (PT6A-6) engine and lengthening the fuselage. An unsolicited proposal to test this airplane was submitted to the Headquarters, US Army Materiel Command (USAMC). Headquarters, USAMC, directed that a comparative military potential test be conducted between a US Army U-6 and the Turbo-Beaver.

b. Headquarters, US Army Test and Evaluation Command (USATECOM), directed the US Army Aviation Test Board (USAAVNTBD) to conduct a category I, comparative, qualitative flight evaluation of the Turbo-Beaver and a standard U-6 in a simulated tactical environment in the vicinity of Fort Rucker, Alabama. USATECOM directed the US Army Aviation Test Activity (USAATA) to examine, without instrumentation, the stability of the Turbo-Beaver and submit a separate qualitative report.

5. Description of Materiel. The Turbo-Beaver Airplane is a high-wing, all-metal, single-engine airplane with a fixed landing gear and tail wheel. A T-74 (PT6A-6) single-stage, free-power-turbine, 550-s.hp. engine drives a three-bladed, reversible-pitch, full-feathering, constant-speed HC-B3TN-3 propeller. The fuselage and the detachable, single-strut mounted, constant-chord wings are semi-monocoque structures. The Turbo-Beaver is essentially a U-6 (Beaver) with the exception of the powerplant, extended fuselage, a small ventral fin, wing fences, and a redesigned vertical fin and rudder. (See inclosure 1 for a detailed description of materiel.)

6. Scope. The US Army Aviation Test Board conducted tests in the vicinity of Fort Rucker, Alabama, to evaluate the military potential of the Turbo-Beaver during the period 3 to 14 May 1965. The test program included 26 hours (5 hours for USAATA) of comparative flight evaluation using a standard U-6 (Beaver) and the Turbo-Beaver. The US Army Aeromedical Research Unit (USAARU) and the US Army Board for Aviation Accident Research (USABAAR) assisted the USAAVNTBD by conducting, respectively, illumination/sound level tests and crash-worthiness-operational safety evaluation.

7. Findings. Detailed findings may be found in inclosure 2.

a. Interior lighting was poor.

b. Exhaust fumes entered the cabin area.

c. In the test configuration, the forward c.g. was exceeded with full fuel and a crew of two.

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SUBJECT: Military Potential Test of the Turbine-Powered U-6 Airplane, USATECOM Project No. 4-5-1020-01

d. The propeller could be inadvertently reversed in flight.

e. The fuel could be shut off when the approach mode was changed to the normal mode by inadvertently going beyond the normal mode position.

f. Seat and restraint systems were below minimum crashworthiness requirements.

g. The Turbo-Beaver compared with the standard Army U-6 Airplane had the following advantages:

(1) Reduced aircraft basic weight

(2) Increased cargo capability in size, shape, and amount of payload

(3) Reduced maintenance requirements

(4) Reduced operating cost (primary consideration was POL requirements)

(5) Increased airspeed

(6) Increased mission range

(7) Increased STOL performance

(8) Increased service ceiling and climb capability

(9) Reduced noise level

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Airplane, USATECOM Project No. 4-5-1020-01

8. Conclusions. The Turbo-Beaver possesses military potential as a STOL fixed-wing utility aircraft and offers improvements over the U-6 Airplane in capability and maintenance suitability at a reduced operating cost. For Army use, however, modifications of the interior lighting, crashworthiness, and operational safety aspects would be required.

9. Recommendations. None.

Charles A Merrett
for RAYMOND E. JOHNSON
Colonel, Artillery
President

5 Incl
1. Detailed Description
2. Details of Test
3. Weight and Balance Forms
4. USAARU Report (Cockpit Light Study)
5. USAARU Report 65-4
6. USABAAR Report

DESCRIPTION OF MATERIEL

The Turbo-Beaver and the U-6

1. External. The Turbo-Beaver is an all-metal, high-wing monoplane.

a. The basic airframe of the U-6 was used in the Turbo-Beaver. The nose cowl was streamlined to fit the gas-turbine engine, and the fuselage was lengthened 30 inches just forward of the leading edge of the wing. These modifications increased the fuselage length by five feet. The rudder assembly was redesigned and increased the height of the airplane by seven inches. The right crew compartment door was changed to a double door 40 inches high and 46 inches wide. The two-bladed propeller was replaced by a three-bladed, reversible-pitch, full-feathering type with the same diameter (8 ft. 6 in.) but a larger pitch range (-14 1/2 degrees to +87 degrees).

Incl 1

Crew compartment with right double door open.
(Note small window over closed left double doors.)

b. The addition of a small window over the crew compartment door, which was moved 30 inches forward of the wing, and enlarging of the overhead windows greatly increased pilot visibility.

2. Internal.

a. Width and height of all compartments were unchanged. The cabin was lengthened by 30 inches between the crew and cargo compartments. This extension increased the floor area by 10 square feet and the cabin volume by 43 cubic feet.

b. Two additional seats were added in the cargo compartment.

c. The oil filler neck was removed from the crew compartment and placed under the engine cowl at the left rear of the engine.

d. The carburetor heat control lever was converted to the bleed-air heat control lever and provided a more positive temperature control.

3. Controls and Instruments.

a. Flight. The flight controls and flight instruments were identical with those in the U-6. A throw-over control column was provided in the test aircraft, but a dual column is also in production. The fuel pressure warning light, located in front of the pilot on the U-6, was converted in the Turbo-Beaver to a stall-warning indicator light.

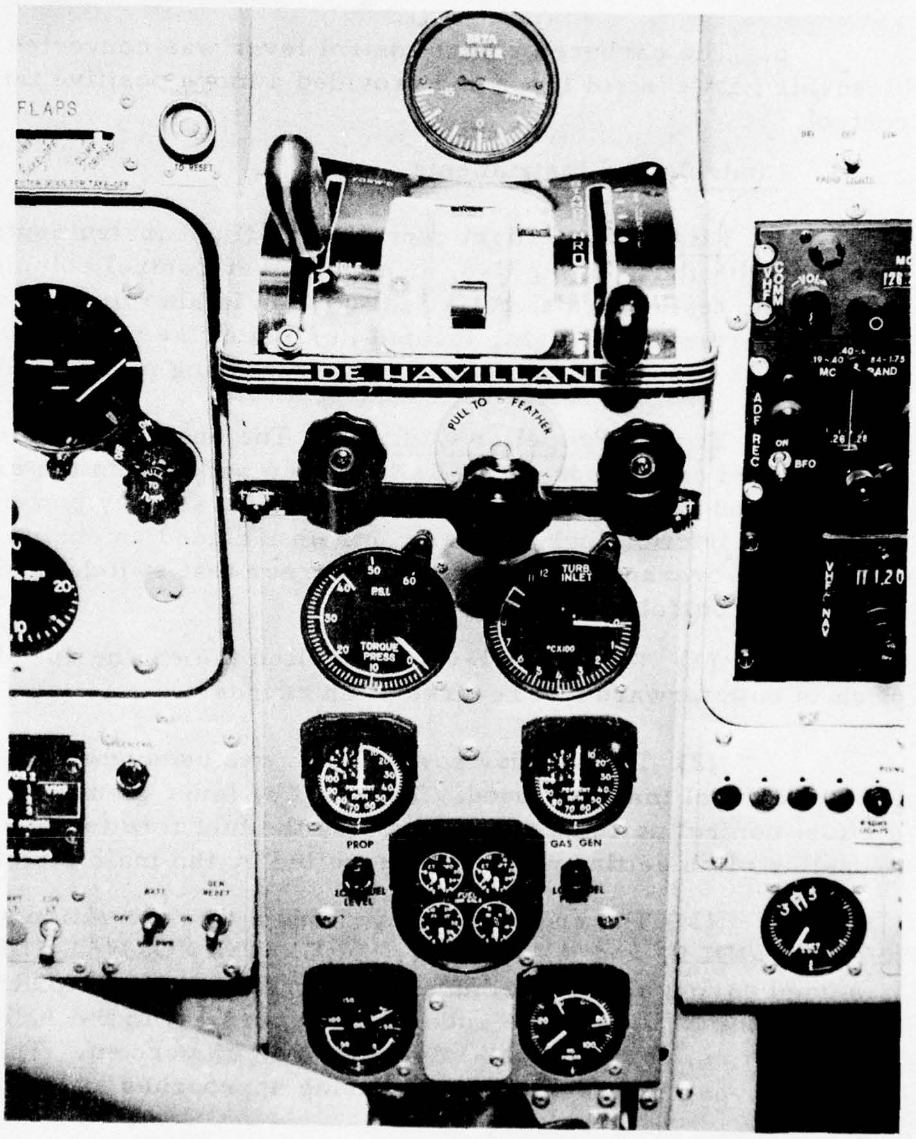
b. Engine/Propeller Controls. The engine/propeller controls were located on a quadrant at the top of the pedestal in the crew compartment and consisted of a power lever and a standby power lever, each with a friction lock. Other controls included an engine fuel lever, a propeller-overspeed (secondary) governor test switch, and a propeller-feathering control knob.

(1) The power lever controlled the engine speed and propeller pitch in both forward and reverse pitch ranges.

(2) The standby power lever was used when the automatic N_1 fuel control malfunctioned. The standby lever manually overrode the fuel control unit and controlled only the fuel flow to the engine. The propeller pitch setting was then controlled by the main power lever.

(3) The engine fuel lever had a three-position switch: OFF, NORMAL-IDLE, and APPROACH-IDLE. The NORMAL-IDLE position was used during all operations except landings. In the NORMAL-IDLE position, the N_1 flight-idle speed was 52 percent; in the APPROACH-IDLE position, the N_1 flight-idle speed was 75 percent. This provided rapid response to power demands during approaches and aborted landings.

(4) The propeller feathering control knob was located directly below the fuel control lever. Regardless of the power lever setting, the knob when pulled out feathered the propeller and unfeathered the propeller when pushed into its normal position.



Engine instrument and control panel

(5) The overspeed governor test switch located to the right of flap-position indicator was used to test the operation of the propeller overspeed governor on the ground.

c. Engine/Propeller Instruments. The engine/propeller instruments were mounted on an engine instrument panel on the face of the pedestal. The instruments and warning lights were: a turbine torquemeter, turbine inlet temperature gauge, gas generator (N_1) tachometer, a propeller tachometer, fuel quantity gauge and oil temperature and oil pressure gauges, low-fuel level, and pressure warning lights. A propeller pitch-position indicator was located on the forward bulkhead directly above the engine/propeller control quadrant (where ADF radio compass indicator was located in U-6). This pitch-position indicator (beta meter) showed the propeller blade angle in low and reverse pitch (+11 degrees to -14 degrees) and was a primary instrument for power approaches and landings.

d. General. All other electrical switches and circuit breakers were the same as on the U-6. The avionics were not standard, but there was sufficient room both on the console and in the baggage compartment to install the standard US Army U-6 avionic package as outlined in reference b, basic letter.

4. Fuel System. The fuel system consisted of three fuselage tanks located beneath the cabin floor and non-jettisonable wing-tip tanks. The center tank consisted of two cells. All fuel flowed to the engine from the center tank under pressure from an electric boost pump. Fuel was transferred from the front and rear tanks to the center tank under pressure from the electric boost pump and controlled by a fuel transfer valve and selector. Fuel was transferred from the wing-tip tanks to the center tank by gravity feed. In the event of boost-pump failure, the fuel could be pumped by the engine-driven fuel pump from any selected fuselage tank up to an altitude of 6,000 feet.

DETAILS OF TEST

A. Introduction. Prior to flight testing, a Turbo-Beaver, S/N CF-SCI, and a standard US Army U-6, S/N 53-2795, were weighed, measured, and airspeed indicators and altimeters calibrated. The U-6 was equipped with a new R-985-39 engine, which had been operated 8 hours and 40 minutes prior to the beginning of test. The T-74 engine installed in the Turbo-Beaver had been flown 133 hours prior to this test. The Turbo-Beaver was certified for a maximum indicated airspeed (IAS) of 148 knots in calm air, but was restricted to 122 knots in turbulent air because of resulting shear forces on the airframe.

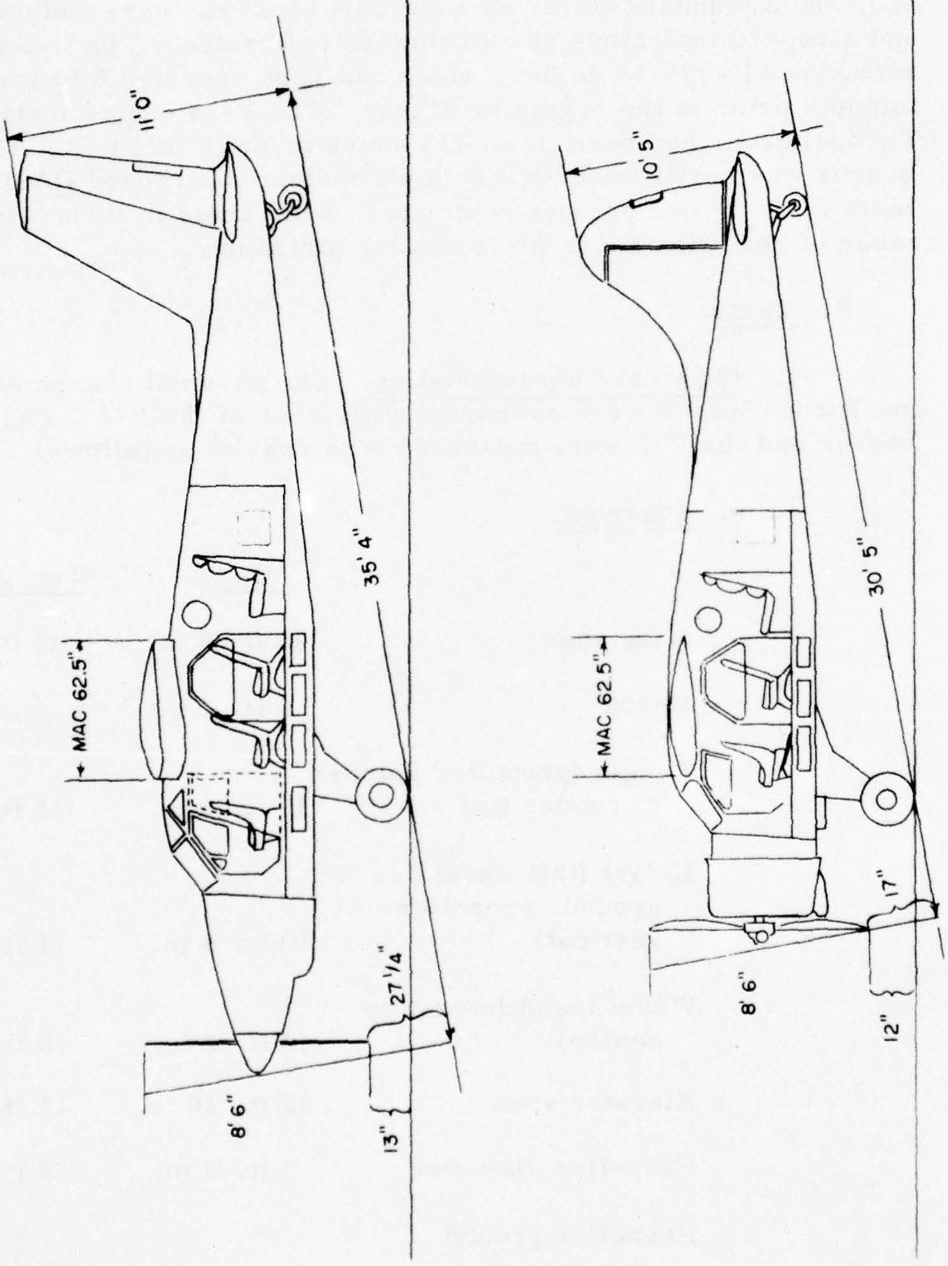
B. Tests.

1. Physical Characteristics. The physical characteristics of the Turbo-Beaver were compared with those of the U-6. The Turbo-Beaver and the U-6 were measured with results as follows:

a. External.

	U-6	Turbo-Beaver
Wing span	48 ft. 0 in.	48 ft. 0 in.
Chord	5 ft. 2 in.	5 ft. 2 in.
Length (propeller spinner to rudder tip)	30 ft. 5 in.	35 ft. 4 in.
Height (tail wheel on ground, propeller vertical)	10 ft. 5 in.	11 ft. 0 in.
Wheel tread (center to center)	10 ft. 2 in.	10 ft. 2 in.
Elevator span	15 ft. 10 in.	15 ft. 10 in.
Propeller diameter	8 ft. 6 in.	8 ft. 6 in.
Propeller ground clearance (level attitude)	1 ft. 0 in.	1 ft. 1 in.

Incl 2



11'0"
35' 4"
MAC 62.5"
27 1/4"
8' 6"
13"
10' 5"
30' 5"
MAC 62.5"
17"
8' 6"
12"

	U-6	Turbo-Beaver
Propeller ground clearance (tail wheel on ground)	1 ft. 9 in.	2 ft. 3 in.

b. Internal.

	U-6	Turbo-Beaver
Crew compartment length (back of seat to instrument panel)	2 ft. 10 in.	2 ft. 10 in.
Crew compartment width	4 ft. 0 in.	4 ft. 0 in.
Crew compartment height (seat cushion to ceiling)	3 ft. 2 in.	3 ft. 2 in.
Crew compartment door width		
Left door	1 ft. 11 in.	1 ft. 11 in.
Right door	1 ft. 11 in.	3 ft. 10 in.
Cargo compartment width	4 ft. 0 in.	4 ft. 0 in.
Cargo compartment floor length	6 ft. 3 in.	8 ft. 8 in.
Cargo compartment height	4 ft. 3 in.	4 ft. 3 in.
Cargo compartment door width	3 ft. 3 1/4 in.	3 ft. 3 1/4 in.

c. Comparative Fuel-Tank Capacities. The fuel was completely drained from all tanks of both airplanes. The tanks were refilled to maximum capacity and the quantity recorded in gallons and computed in pounds. The results were as follows:

	U-6		Turbo-Beaver	
	US Gal.	Pounds	US Gal.	Pounds
Front tank	35.7	214.2	52.3	340.0

	U-6		Turbo-Beaver	
	US Gal.	Pounds	US Gal.	Pounds
Center tank	35.6	213.6	68.3*	443.5
Rear tank	25.5	153.0	24.2	157.3
Wing-tip tanks	43*	258.0	43*	280.0
TOTAL	139.8	838.8	187.8	1220.8

d. Weight and Balance.

(1) The U-6 and the Turbo-Beaver were weighed and the center of gravity (c.g.) determined. This weight was used to compute weight and balance forms for all test flights. Neither aircraft was equipped with a standard avionics package; therefore, a standard basic weight was computed to determine the available payload for the 50- and 200-nautical mile mission profiles, with both aircraft in a typical US Army configuration.

	U-6 (lb.)	Turbo-Beaver (lb.)
Basic weight (as weighed)	3522	2842
Less installed avionics	-179	-94
Plus standard UHF avionics package**	+212	+212
Plus dual controls		+9
Computed basic weight	3553	2969

*Two units

**The standard CONUS UHF avionic configuration for the U-6 as outlined in the five-year plan for US Army aircraft standard avionics and surveillance configuration (reference b) indicates:

Type No.	Nomenclature	Weight (lb.)
AN/ARC-44	Radio Set (FM)	34.0

	U-6 (lb.)	Turbo-Beaver (lb.)
Plus full fuel and oil	+885	+1242
Plus crew (one)	+200	+200
Operating weight (minimum crew-maximum fuel)	4638	4411

(2) The c.g. of the Turbo-Beaver in the test configuration with a crew of two, fuselage fuel tanks full, wing tanks full or empty, and no cargo was one inch forward of allowable limits. With the substitution of the standard avionic package for the test avionics, the forward c.g. limit would not be exceeded in the same configuration.

Avionic configuration continued

Type No.	Nomenclature	Weight (lb.)
AN/ARC-55	Radio Set (UHF)	65.0
AN/ARN-59(V)	Direction Finder Set (ADF)	21.0
AN/ARN-30D	Radio Receiving Set (OMNI)	25.5
AN/ARA-31	Antenna Group W/Keyer (FM Homer)	6.0
R-1041/ARN	Marker Beacon	3.3
AN/APX-44	Transponder Set (IFF)	28.3
AN/ARR-( )	Auxiliary Receiver (FM)	5.0
SB-329/AR	Panel Signal Distr (2)	3.0
MX-1646/AIC	Adapter Headset Microphone (2)	4.0
AT-1108/ARC	Antenna (UHF)	3.3
CV-1275/ARC	Converter (RMI)	3.0
AT-454	Antenna (FM)	4.0

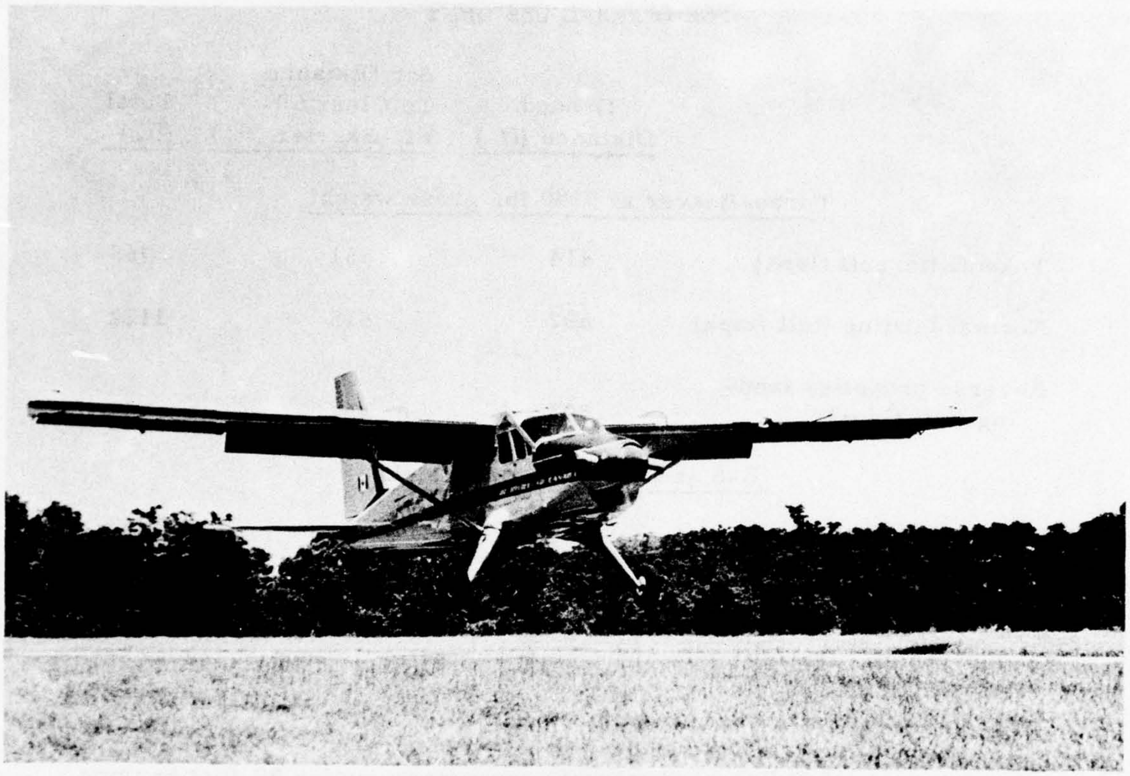
2. STOL Characteristics. The Turbo-Beaver and the U-6 performed side-by-side STOL takeoffs and landings, using a Fairchild analyzer to record data. The wind was variable 4-10 knots from 45 to 135 degrees to runway and a density altitude of 2000 feet at 85°F. OAT. Results were as follows:

a. The Fairchild analyzer showed that, at both 4500 and 5100 pounds gross weight, the Turbo-Beaver decreased by 26 percent the distance required for takeoff over a 50-foot barrier. By reducing the pitch of the propeller during the approach and reversing the propeller on ground contact, the distance required to land the Turbo-Beaver over a 50-foot barrier was reduced by 26 percent at 4500 pounds gross weight and by 36 percent at 5100 pounds gross weight. However, when the Turbo-Beaver was landed over the 50-foot barrier using currently-prescribed power approach technique without reducing pitch or reversing the propeller, the landing distance required was the same as for the U-6.

	Ground Distance (ft.)	Air Distance To Clear 50-Ft. Barrier (ft.)	Total (ft.)
Turbo-Beaver at 4500 lb. gross weight			
Takeoff (takeoff flaps)	331	282	613
Normal landing (full flaps)	565	508	1073
Reverse propeller landing (full flaps)	334	444	778

Avionic configuration continued

Type No.	Nomenclature	Weight (lb.)
AS-580A	Antenna (OMNI)	4.0
AT-780	Antenna (ADF)	5.0
TOTAL		212.4



The Turbo-Beaver takes off from a sod strip.

	Ground Distance (ft.)	Air Distance To Clear 50-Ft. Barrier (ft.)	Total (ft.)
U-6 at 4500 lb. gross weight			
Takeoff (takeoff flaps)	358	483	841
Landing (full flaps)	518	548	1066

	Ground Distance (ft.)	Air Distance To Clear 50-Ft. Barrier (ft.)	Total (ft.)
Turbo-Beaver at 5100 lb. gross weight			
Takeoff (takeoff flaps)	414	351	765
Normal landing (full flaps)	607	515	1122
Reverse propeller landing (full flaps)	303	451	754
U-6 at 5100 lb. gross weight			
Takeoff (takeoff flaps)	613	422	1035
Landing (full flaps)	509	672	1181

b. The decrease in required landing distance at the higher gross weight was attributed to the increase in proficiency and confidence gained by the pilots during testing.

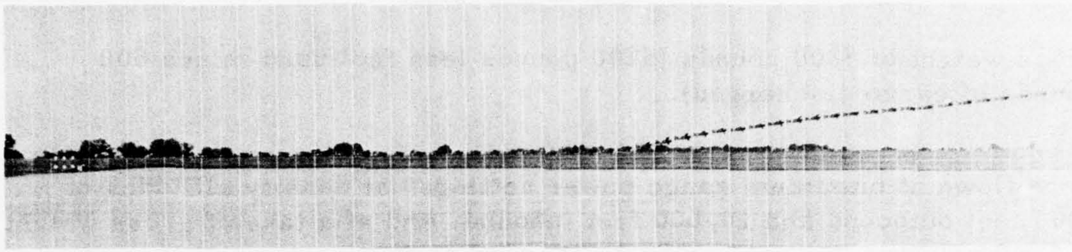
c. Landings and takeoffs were made over a 50-foot barrier on a sod field strip. The results were comparable to the tests conducted on the prepared runway.

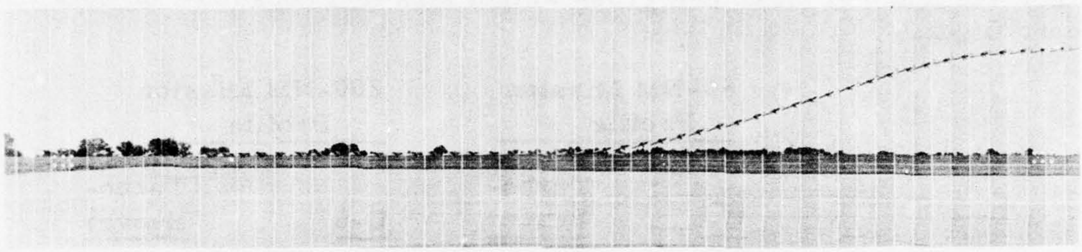
d. In areas of dry soil and dust, reversing the propeller left a distinctive signature, which could disclose a concealed location.

3. Mission Capability.

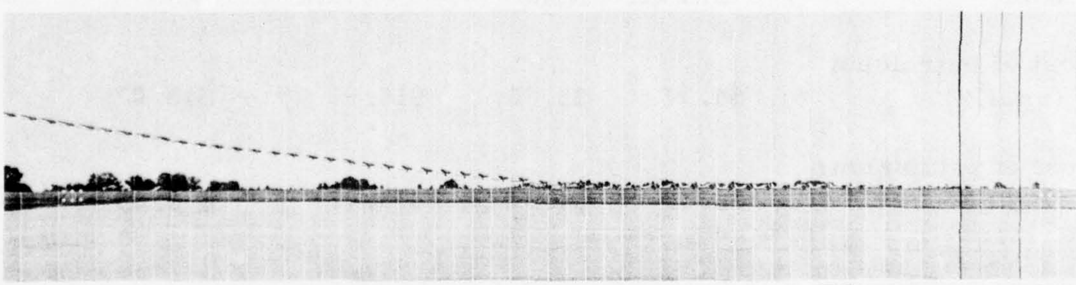
a. Side-by-side, 50-nautical-mile (NM), radius-of-action mission profiles were flown at maximum cruise speed power settings (U-6 - 2200 r.p.m., 33.7 in. m.p.; Turbo-Beaver* - 80 percent r.p.m., 24 lb. torque), 3000-feet density altitude and at takeoff gross weight of 5100 pounds outbound. Six hundred pound of cargo were discharged at the destination and the return flight was flown at an approximate takeoff

*This power setting produced the maximum cruise speed which would not exceed the 122-knot airspeed restriction in turbulent air.





Takeoff of the U-6 (above) and Turbo-Beaver (below) as recorded by the flight analyzer.



Landing of the U-6 (above) and Turbo-Beaver (below) as recorded by the flight analyzer.

gross weight of 4300 pounds (5100 pounds less fuel used minus 600 pounds of cargo discharged).

b. Side-by-side 200-NM radius-of-action mission profiles were flown at maximum range power settings* at density altitudes of 5000 feet outbound and 10,000 feet inbound, and at a takeoff gross weight of 5100 pounds. No cargo was discharged at destination and the return flight was made at maximum gross weight less fuel consumed on outbound flight.

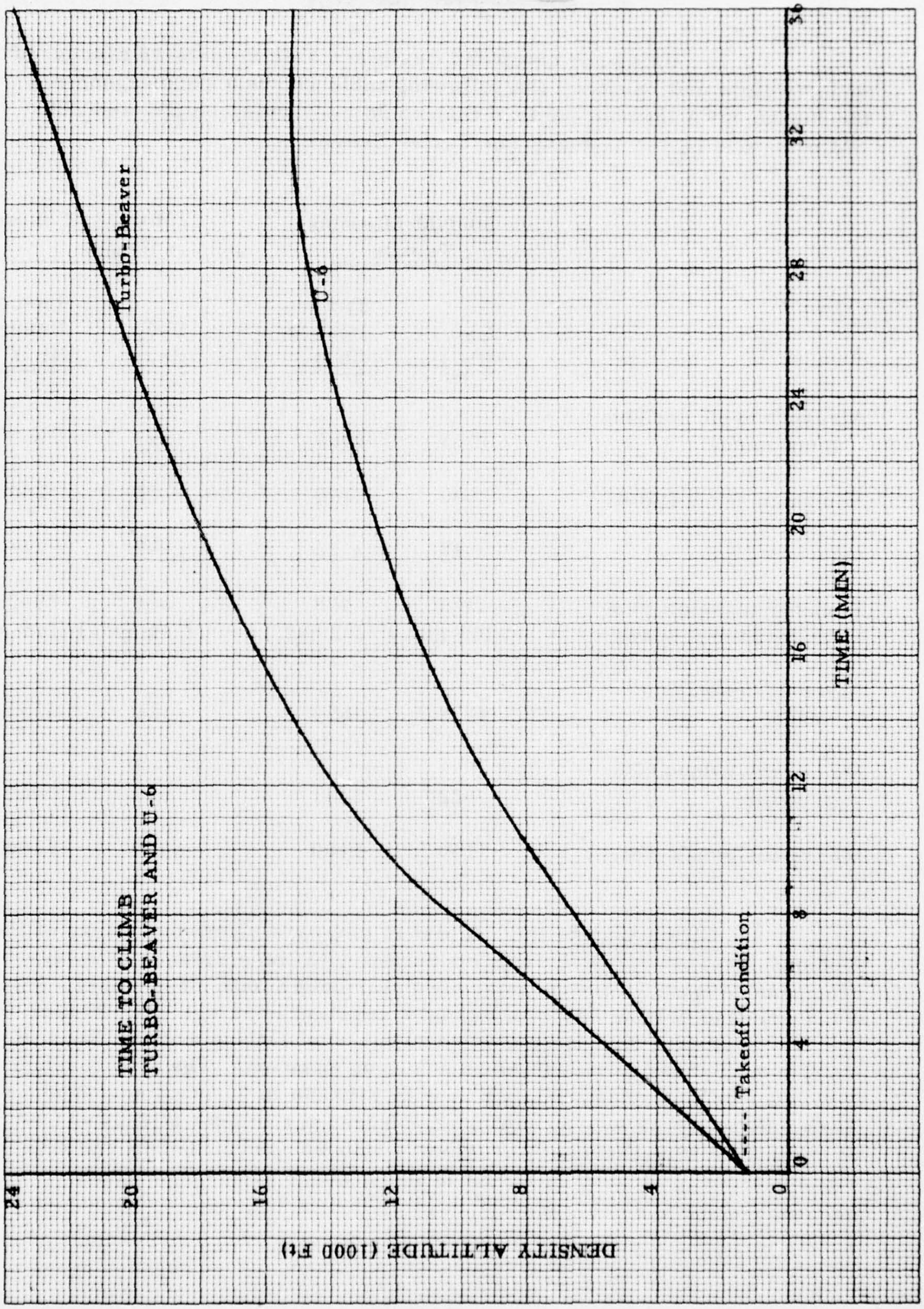
	50-NM Mission Profile		200-NM Mission Profile	
	U-6	Turbo-Beaver	U-6	Turbo-Beaver
Flight time	59 min.	53 min.	4 hr. 1 min.	3 hr. 15 min.
Ground speed (average)	107 knots	119 knots	99.3 knots	123 knots
Fuel used (total)	38 gal.	38 gal.	95.9 gal.	120.1 gal.
Oil used (total)	2 qt.	None	4 qt.	None
Gallons of fuel/flight hour	38.6 gal.	43.1 gal.	24.6 gal.	36.9 gal.
Quarts of oil/flight hour	2.4 qt.	None	.99 qt.	None
Cost of petroleum (total)**	$6.34	$3.80	$15.92	$12.01
Cost of petroleum/flight hour**	$6.45	$4.31	$ 3.97	$ 3.69

*U-6 at 5000 ft. density altitude - 1600 r.p.m., 28.4 in. m.p.; at 10,000 ft. density altitude - 1850 r.p.m., 25.3 in. m.p. Turbo-Beaver at 5000 ft. density altitude, 85% r.p.m., 24 lb. torque; at 10,000 ft. density altitude, 85% r.p.m., 23.5 lb. torque.
**See paragraph 8, Operating Costs.

c. Using the computed basic aircraft weights as discussed under weight and balance, the following table shows a comparison of the maximum allowable payload that could be carried on 50- and 200-NM missions by the U-6 and the Turbo-Beaver.

	50-NM Mission Profile		200-NM Mission Profile	
	U-6 (lb.)	Turbo-Beaver (lb.)	U-6 (lb.)	Turbo-Beaver (lb.)
Aircraft basic weight (computed)	3553	2969	3553	2969
Minimum crew (pilot)	200	200	200	200
Oil	47	22	47	22
Fuel for mission plus 45-minute reserve	378 (63 gal.)	468 (72 gal.)	666 (111 gal.)	940 (145 gal.)
Aircraft-operating weight	4178	3659	4466	4131
Maximum-allowable payload	922	1441	633	969
Maximum gross weight	5100	5100	5100	5100

4. Climb Capability. A test to compare climb capability of the U-6 and the Turbo-Beaver was conducted with the airplanes at a take-off gross weight of 5100 pounds. Both airplanes took off together, using a takeoff-flap setting and climbed on a constant heading. At 300 feet, the U-6 continued the climb using a climb-flap setting and the flaps in the Turbo-Beaver were raised to a full-up position. The U-6 reached a service ceiling of 15,200 feet density altitude in 31 minutes. The Turbo-Beaver was still climbing at 350 feet per minute at 24,000 feet, 36 minutes after takeoff. No further climb was permitted by air traffic control because of other aircraft in the positive control air space.


TIME TO CLIMB
TURBO-BEAVER AND U-6
Turbo-Beaver
U-6
Takeoff Condition
TIME (MIN)
0
4
8
12
16
20
24
28
32
36
DENSITY ALTITUDE (1000 Ft)
0
4
8
12
16
20
24

Average Rate of Climb

Density Altitude	U-6	Turbo-Beaver
0-5000 ft.	875 ft. /min.	1200 ft. /min.
5000 ft. - 10,000 ft.	625 ft. /min.	1200 ft. /min.
10,000 ft. - 15,000 ft.	320 ft. /min.	800 ft. /min.
15,000 ft. - 20,000 ft.		450 ft. /min.
20,000 ft. - 24,000 ft.		360 ft. /min.

5. Suitability of the Aircraft Configuration.

a. Ground Handling. The ground-handling characteristics of the U-6 and the Turbo-Beaver were identical. Each aircraft could be pushed or pulled by two men over paved or sod surfaces. One man could pull or push the airplanes on level paved surfaces using a tail-wheel tow bar. A small aircraft line tug, using a tail-wheel tow bar, was used to tow the airplanes for routine ground handling. Because of the extended length of the Turbo-Beaver, the forward towing tow bar, which attaches to the main landing gear could not be used; the three-bladed propeller interfered with the operation of the tug.

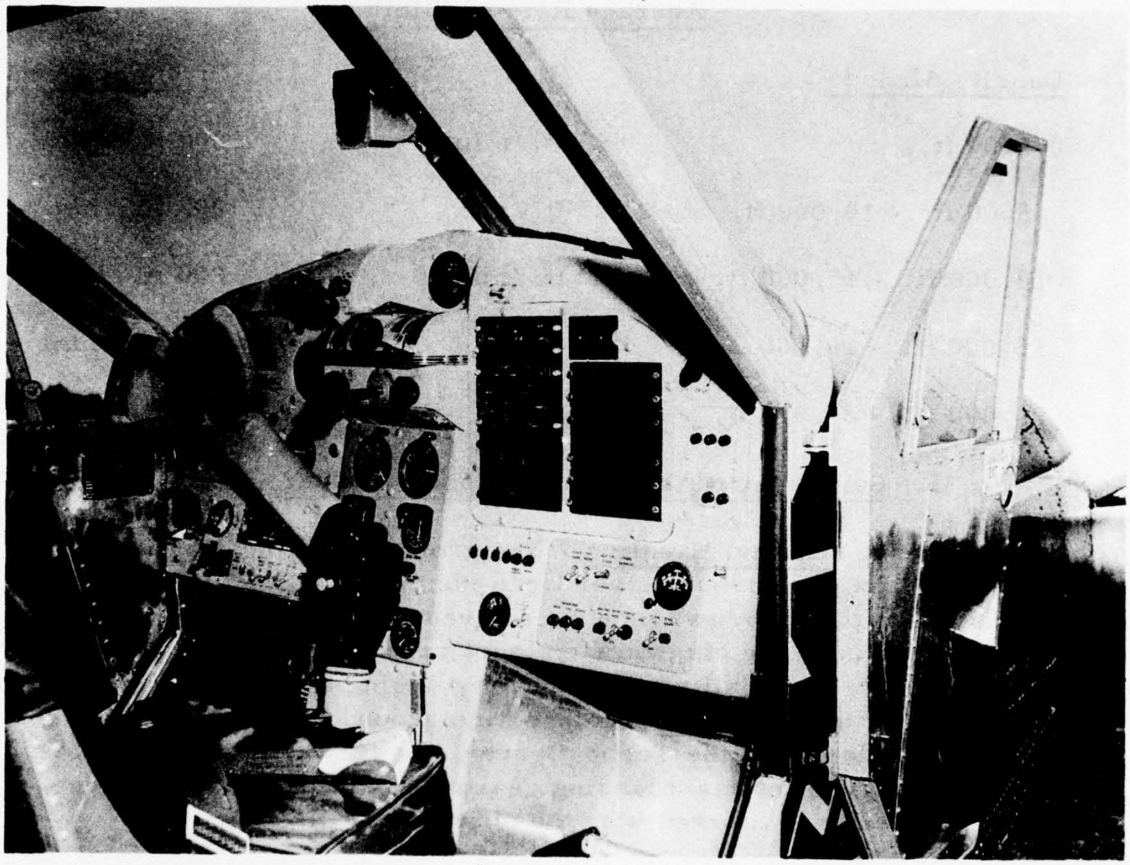
b. Interior Lighting. A subjective evaluation of the cockpit lighting was made by the US Army Aeromedical Research Unit (USAARU) during daylight and night in-flight environment (see inclosure 4). The following deficiencies were noted:

(1) Some of the instruments were not adequately illuminated. The gyro-vacuum, external temperature and voltage indicator, beta meter, and clock had no illumination.

(2) Markings on controls, instructions, and name plates were inadequately illuminated.

(3) Reflections were present on the windshield during both daylight and darkness.

(4) The cabin light interfered with pilot night vision.



Turbo-Beaver crew compartment and instrument panel

(5) No spare lamps were provided.

(6) The landing light shone into the cockpit and interfered with vision during landing.

(7) Distortion was noticeable in the windshield.

c. Human Engineering. The cockpit arrangement, size, and configuration were identical with those of the U-6. All controls could be operated by the crew when wearing winter clothing.

d. Noise Level. An evaluation of the noise spectra of the Turbo-Beaver was conducted by the US Army Aeromedical Research Unit (USAARU). The USAARU report (Report No. 65-4) is contained in inclosure 5.

e. Visibility. When the 30 inches were added to the cabin area, the crew compartment was moved forward in front of the leading edge of the wing. The overhead windows were enlarged. A large window was placed behind the crew compartment door and a small triangular window was added over this door. These modifications increased the visibility to a great extent. This increase was particularly evident in steep turns. The nose-high attitude on climb-out made forward visibility poor but in the three-point and level-flight attitude, the smaller engine cowling increased the visibility approximately 50 percent.

f. Cabin Configuration. The cargo compartment doors were the same size as the U-6; however, the right crew compartment door was made into a larger double door. The loading and unloading of long items such as stretchers, rotor blades, etc., were made easier by loading through the left cargo door, extending the front end out the right double door, turning the rear of the load into the cabin and sliding the front end back in the double door. The loading techniques for all other typical utility loads in both airplanes were comparable. The additional length of the Turbo-Beaver cabin accommodated additional cargo bulk and provided more work space for the loading team.

g. Safety. The US Army Board for Aviation Accident Research (USABAAR) conducted a safety evaluation of the Turbo-Beaver on 13 May 1965 (inclosure 6). These items were found to be below minimum safety requirements:

(1) Exhaust fumes entered the cockpit and cargo area. These fumes were extremely heavy in the aft cargo area. This was considered very detrimental to crew and passengers.

(2) The aircraft was one inch out of the maximum forward c.g. limit when loaded with full fuel and two people in the pilot's compartment. It took 100 pounds of weight in the aft cargo compartment to offset this imbalance.

(3) It was very easy to reverse the propeller in flight. The power quadrant was not designed to prevent this or to furnish adequate awareness to the pilot of impending reversal.

(4) The fuel control lever design permitted inadvertent shut-off of the fuel.

(5) The engine instrument location was very poor. The engine and propeller tachometers were located on the lower middle panel and were very difficult to read. The instruments were very small and would present quite a problem in reading them during a night emergency.

(6) The seats and restraint system were very poor. The seats were attached to hardpoints in the floor. However, the seat itself was made of tubular steel with stress concentrations at the tie-down point. Seat belts were attached to the seats. The entire restraint system was far below minimum crashworthiness requirements.

6. Ease of Maintenance. Maintenance of the Turbo-Beaver was performed by the manufacturer's representatives throughout the test and monitored by USAAVNTBD personnel.

a. Airframe Maintenance. Due to the limited flying time required by the test, only organizational maintenance (preflights, postflights, and daily inspections) was performed. The airframe inspections of the U-6 and Turbo-Beaver were so similar that the difference in man-hour requirements was considered negligible. However, in comparison with the U-6, there appeared to be many features of the Turbo-Beaver which would assist the mechanic in performing his duties more easily and reduce the special tool requirement.

b. Engine Area. All engine components were easily accessible. One piece of hinged cowling under the engine exposed the complete lower part of the engine. A large front top panel secured at the top and sides by spring-loaded fasteners provided easy access to the forward part of the engine. Two pieces of hinged paneling at rear top side provided easy access to the accessory section. This use of snap fasteners and hinges on access panels provided easier engine access and larger work space than did the large engine cowl of the U-6.

Nose of the Turbo-Beaver with lower engine-access cowling open

c. Cockpit Area. The oil filler neck had been removed from the copilot's side of the cockpit. Oil service was at the top aft section of engine area. This eliminated the problem of oil spillage in the cockpit area, which was prevalent in the U-6.

d. Cabin Area.

(1) The stick-on and snap-type soundproofing was readily removed and replaced. As a result, upper controls for the flaps and ailerons were more accessible.

(2) Fuel tanks under the floor of cabin and cockpit were reached by removing the floor; however, the forward tank had been moved further forward in the aircraft, and the pilot and copilot seats had to be removed in order to inspect this cell.

e. Underside of Aircraft. All lower flight controls were accessible through an access panel. There was much more room to work in this area than in that of the U-6.

f. Powerplant. The powerplant did not require a scheduled inspection during the test; however, experienced turbine mechanics were utilized to study the engine and airframe maintenance manuals and physically remove the engine cowl in order to estimate the man-hour requirements for removal and installation of the PT6A-6 engine. The following comparison is shown with the U-6 R-985-39 engine;

	U-6 R-985-39	Turbo-Beaver PT6A-6
Time to remove	30 man-hours	6 man-hours
Time to build-up and install	45 man-hours	10 man-hours
Time between overhaul (TBO)	1400 hours of operation	600 hours of operation

7. Transition-Training Requirements. The transition-training requirements for normal starting and shutdown and nontactical flight requirements were minimal. In order to take full advantage of the braking action of the reversible propeller, a change in short-field technique was developed. This technique required additional pilot proficiency and confidence in the aircraft.

8. Operating Cost. The table below shows the comparative operating costs of petroleum products only. During the short test period, no significant maintenance was performed.

	U-6	Turbo-Beaver
Fuel used per flight hour	22.3 gal.	28.5 gal.
Oil used per flight hour	1.3 qt.	None
Fuel cost per flight hour		
(115/145 - 16¢ per gal. JP-4 - 10¢ per gal.)	$3.57	$2.85
Oil cost per flight hour		
(13¢ per qt.)	$ .17	
Total cost per flight hour for this test.	$3.74	$2.85

~~FOR OFFICIAL USE ONLY~~

WEIGHT AND BALANCE CLEARANCE FORM F
TRANSPORT
(USE REVERSE FOR TACTICAL MISSIONS)

Cross Reference RAF Form 2670 RCAF Form F. 115 C 80M 6-61 (6797)

FOR USE IN T. O. 1-1B-40 & AN 01-1B-40

DATE	AIRCRAFT TYPE	FROM	HOME STATION
5 May 1965	Turbo-Beaver	Local	Ft. Rucker, Ala.
MISSION/TRIP/FLIGHT/NO.	**SERIAL NO.**	**TO**	**PILOT**
Air speed calibration	CF-SCI	Local	Maj. Mierswa

LIMITATIONS

CONDITION	TAKEOFF	LANDING	LIMITING WING FUEL
[2] ALLOWABLE GROSS WEIGHT	5100	5100	5100
TOTAL AIRCRAFT WEIGHT (Ref. 11)	4222		
OPERATING WEIGHT PLUS ESTIMATED LANDING FUEL WEIGHT			
OPERATING WEIGHT (Ref. 8)			3263
ALLOWABLE LOAD (Ref. 12) (use SMALLEST figure)	878		1837
[3] PERMISSIBLE C. G. TAKEOFF	FROM 195.0	TO (% M.A.C. or IN.) 205.0	
[4] PERMISSIBLE C. G. LANDING	FROM 194.4	TO (% M.A.C. or IN.) 205.0	
[5] LANDING FUEL WEIGHT	686.0		

REF	ITEM	WEIGHT	[1] INDEX OR MOM/
1	BASIC AIRCRAFT (From Chart C)	2 8 4 2 0	5 5 9 5 9
2	OIL (2.5 Gal.)	2 1 7	2 5 2
3	CREW (No.) two	4 0 0 0	6 5 2 0
4	CREW'S BAGGAGE		
5	STEWARD'S EQUIPMENT		
6	EMERGENCY EQUIPMENT		
7	EXTRA EQUIPMENT		
8	OPERATING WEIGHT	3 2 6 3 7	6 2 7 2 1
9	TAKEOFF FUEL (147 Gal.)	9 5 9 0	1 9 1 2 0
10	WATER INJ. FLUID (Gal.)		
11	TOTAL AIRCRAFT WEIGHT	4 2 2 2 7	8 1 8 4 1

REMARKS

Front Tnk	343	580
Ct. Tnk	452	938
Rear Tnk	164	394
	959	1912
	lbs	mom
		100

12 DISTRIBUTION OF ALLOWABLE LOAD (PAYLOAD)

COMPT	UPPER COMPARTMENTS PASSENGERS NO.	WEIGHT	CARGO	COMPT	LOWER COMPARTMENTS PASSENGERS NO.	WEIGHT	CARGO
A							
B							
C							
D		A/C 1" out of forward C G on take					
E		off. Add 100 pounds at station 262.					
F							
G							
H							
I							
J							
K							
L							
M							
N							
O							
P							
FWD	BELLY						
AFT	BELLY						

TOTAL FREIGHT

TOTAL MAIL

COMPUTER PLATE NUMBER (If used)

[1] Enter constant used.
[2] Enter values from current applicable T. O.
[3] Applicable to gross weight (Ref. 15).
[4] Applicable to gross weight (Ref. 18).
[5] Ref. 9 minus Ref. 17.

CORRECTIONS (Ref. 14)

COMPT	ITEM	CHANGES (+ or −) WEIGHT	[1] INDEX OR MOM/
TOTAL WEIGHT REMOVED		−	−
TOTAL WEIGHT ADDED		+	+
NET DIFFERENCE (Ref. 14)			

REF	ITEM	WEIGHT	[1] INDEX OR MOM/
13	TAKEOFF CONDITION (Uncorrected)	4 2 2 2 7	8 1 8 4 1
14	CORRECTIONS (If required)		
15	TAKEOFF CONDITION (Corrected)	4 2 2 2 7	8 1 8 4 1
16	TAKEOFF C. G. IN % M. A. C. OR IN.	194 "	
17	LESS FUEL	2 7 3 0	4 6 1 0
18	LESS AIR SUPPLY LOAD DROPPED		
19	MISC. VARIABLES		
20	ESTIMATED LANDING CONDITION	3 8 4 9 7	7 7 2 3 1
21	ESTIMATED LANDING C. G. IN % M. A. C. OR IN.	200.6 "	

COMPUTED BY
/s/ Myles H. Mierswa
SIGNATURE

WEIGHT AND BALANCE AUTHORITY
SIGNATURE

PILOT
/s/ Myles H. Mierswa
/t/ MYLES H. MIERSWA
SIGNATURE

NOTE.—THIS TRANSPORT CLEARANCE FORM HAS RESULTED FROM TRIPARTITE AGREEMENT AND NO FURTHER CHANGES MAY BE MADE TO IT WITHOUT PRIOR CONSIDERATION BY TRIPARTITE AUTHORITIES.

Incl 3

DD FORM 1 SEPT 54 365F

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DEPARTMENT OF THE ARMY
U.S ARMY AEROMEDICAL RESEARCH UNIT
Fort Rucker, Alabama 36362

USAARU - LCR

13 May 1965

SUBJECT: Cockpit Light Study on the Turbo-Beaver U-6 (Model DHC-2, Mark III)

TO: President
United States Army Aviation Test Board
ATTN: Major Mierswa
Fort Rucker, Alabama 36362

An evaluation of the cockpit lighting was made during daylight and night in-flight environments. Subjective evaluation was performed due to the time required for a more thorough study. This was accomplished in accordances with the standard USAARU cockpit light study review procedure. Results of this evaluation are as follows:

a. Are all instruments adequately illuminated? No - gyro vacuum, external temperature, clock, generator charge and beta meter. Of these, beta meter is critical for landing and rapid descents.

b. Are they illuminated uniformly? No. Is there sufficient intensity? Yes.

c. Is illumination controllable to very low intensities? Yes (Rheostat). Only flight instruments are on rheostat. The radio panel lights are on dim or bright only.

d. Are markings of instruments readable? Yes. Only the flight instruments are illuminated, readable. Of these the oil pressure gauges are hidden behind the control yoke.

e. Are all controls, instructions, and nameplates adequately illuminated? No.

Incl 4

USAARU-LCR 13 May 1965
SUBJECT: Cockpit Light Study on the Turbo-Beaver U-6 (Model DHC-2, Mark III)

f. Are they illuminated uniformly? No. Is there sufficient intensity? No.

g. Is illumination controllable to very low intensities? No, not on panel - only main flight instrument.

h. Are markings on controls, instructions and nameplates readable? During daylight or auxiliary lighting modes only.

i. Is the intensity of lighting for some instruments and controls controlled separately? Yes - main instrument on rheostat, radio on high low switch.

j. Is flood lighting provided? No (only by adjusting spotlights Grimes, type C-4A). Is the light standard red? Yes.

k. Is the power source independent of normal lighting circuit? No. All lights are on the main battery circuit.

l. Are there any sources of light which give other than standard red light? Yes. Adjustable Grimes and the cargo compartment.

m. Are there any reflections in the windshield, windows, canopy or other reflecting surfaces which interfere with visibility inside or outside the cockpit? The defroster reflects in lower part of windshield during daylight; instruments reflect into the windshield at night.

n. Is there light leakage into the cockpit from other compartments? Yes. No shield from cargo to pilot compartment.

o. Are spare lamps provided in sufficient quantity and easily accessible? No.

p. Are all instruments, instructions, nameplates, and control markings readable in daylight? Yes.

q. Can warning and caution lights be dimmed sufficiently for night operation? Yes.

USAARU-LCR 13 May 1965
SUBJECT: Cockpit Light Study on the Turbo-Beaver U-6 (Model DHC-2, Mark III)

r. Are warning and caution lights of sufficient intensity for daylight use? No.

s. Are warning and caution lights on the main dimming circuit? No.

t. Is lighting provided in accordance with the aircraft detail specification? Unknown.

u. Is the light adequate for reading? Yes.

v. Does the light cause glare to cockpit? No.

w. Is there adequate general illumination for the compartment? Yes.

x. Do any of the exterior lights provide glare in the cockpit? Yes. The landing light shines into the cockpit and interferes with vision during landing.

y. Is exterior lighting provided in accordance with FAA? Yes.

z. Distortion was noticeable in the windshield.

/s/ Robert W. Bailey
/t/ ROBERT W. BAILEY
Lt. Colonel, MSC
Investigator

DEPARTMENT OF THE ARMY
U. S. ARMY AEROMEDICAL RESEARCH UNIT
FORT RUCKER, ALABAMA 36362

USAARU-LCR 28 May 1965

SUBJECT: Noise Spectra of the Turbo-Beaver

TO: President
United States Army Aviation Test Board
ATTN: Major Mierswa
Fort Rucker, Alabama 36362

Attached is an advanced copy of USAARU Report 65-4 in accordance with your request for information about the Turbo-Beaver.

Robert W. Bailey
ROBERT W. BAILEY
Lt Colonel, MSC
Commanding

1 Incl
as (dupl)

Incl 5

NOISE SPECTRA OF THE TURBO-BEAVER

INTRODUCTION

A DeHavilland Turbo-Beaver was made available to the Aeromedical Research Unit for measurement of noise spectra. The Turbo-Beaver is an all metal aircraft with high wing, a single engine and fixed landing gear. It is powered by a Pratt and Whitney PT6A-6 engine which is a single-stage free power turbine. The propeller is a constant speed HC-B3TN-3 which is 102 inches in diameter, reversible pitch and has full feathering capability.

PROCEDURE

Measurements of the internal noise sound pressure levels were made during taxi, take-off and cruising power configurations at various positions in the aircraft. The sound pressure level of the full audio spectrum (FAS) and ten octave bands were measured at positions near the co-pilot's seat, the right passenger's seat in the first row behind the pilot's seat, the left passenger's seat in the second row, and the rear seat.

INSTRUMENTATION

The sound pressure level measurements were made with a Brüell and Kjaer precision sound level meter type 2203, a Brüel and Kjaer 4132 condenser microphone and a Brüel and Kjaer type 1613 octave-band filter set. An acoustical calibration of the microphone and sound level meter was accomplished with a Brüel and Kjaer type 4220 pistonphone.

In the tables and figures where results of the octave-band analysis are given, the center frequencies (f_c) are defined as the center of each octave-band of which the 3 db attenuation cut-off frequencies below and above f_c on a logarithmic scale are $f_c/\sqrt{2}$ and $f_c \times \sqrt{2}$ respectively. The Brüel and Kjaer type 1613 octave-band filter set yield a 40 db per octave slope from the cutoff frequencies. Table 1 contains the center frequency (f_c) and the cutoff boundry frequencies for each of the ten octave bands measured with the Brüell and Kjaer filters. Table 2 contains similar data on the General Radio filters that were used to analyze the noise spectrum of U-6A the results of which are given in USAARU Report No. 64-1.

RESULTS AND DISCUSSION

Table 3 contains the sound pressure level measured under taxi, slow cruise, normal cruise and take-off conditions. The range of overall levels of the full audio spectra extended from 94 db to 112 db under the various power settings. The rank order of the power conditions with respect to sound pressure level (from the lowest to highest) was taxi, slow cruise, normal cruise and take-off for the full audio spectra and all octave-bands except two. The octave-bands with 125 cps and 500 cps as center frequencies had higher sound pressure levels in the normal cruise condition than was measured in the take-off condition.

TABLE 1

Center and Boundry Frequencies of the Brüel and Kjaer Type 1613
Octave-Band Filter Set

Center Frequencies (f_c)	Boundry Frequencies Lower	Boundry Frequencies Upper
31.5 cps	22.3 cps	44.5 cps
63 cps	44.5 cps	89.1 cps
125 cps	88.4 cps	176.8 cps
250 cps	176.8 cps	353.6 cps
500 cps	353.6 cps	707.1 cps
1000 cps	707.1 cps	1414.2 cps
2000 cps	1414.2 cps	2828.4 cps
4000 cps	2828.4 cps	5656.9 cps
8000 cps	5656.9 cps	11313.7 cps
16000 cps	11313.7 cps	22627.4 cps

TABLE 2

Center and Boundry Frequencies of the General Radio Octave-Band Filters

Center Frequencies (f_c)	Boundry Frequencies Lower	Boundry Frequencies Upper
53.0 cps	37.5 cps	75 cps
106.1 cps	75 cps	150 cps
212.1 cps	150 cps	300 cps
424.3 cps	300 cps	600 cps
848.5 cps	600 cps	1200 cps
1697.1 cps	1200 cps	2400 cps
3394.1 cps	2400 cps	4800 cps
6788.2 cps	4800 cps	9600 cps

TABLE 3

Sound Pressure Levels of Octave-Bands and Full Audio Spectra Measured in Front of the Right Pilot's Seat in the DeHavilland Turbo-Beaver Under Various Power Conditions

Octave-Band Center Frequencies (f_c)	Taxi	Slow Cruise	Normal Cruise	Take-Off
31.5 cps	93 db	93 db	97 db	107 db
63 cps	86 db	93 db	100 db	100 db
125 cps	85 db	95 db	105 db	100 db
250 cps	76 db	91 db	97 db	97 db
500 cps	76 db	92 db	99 db	98 db
1000 cps	75 db	87 db	96 db	102 db
2000 cps	72 db	81 db	88 db	94 db
4000 cps	70 db	76 db	84 db	88 db
8000 cps	72 db	72 db	80 db	84 db
16000 cps	73 db	66 db	74 db	75 db
Full Audio Spectra	94 db	101 db	108 db	112 db

Figure 1 depicts the spectra contours of the taxi and take-off conditions. The area between these contours may be considered to be the sound pressure level limits of the various portions of the spectra under all operating conditions of the aircraft.

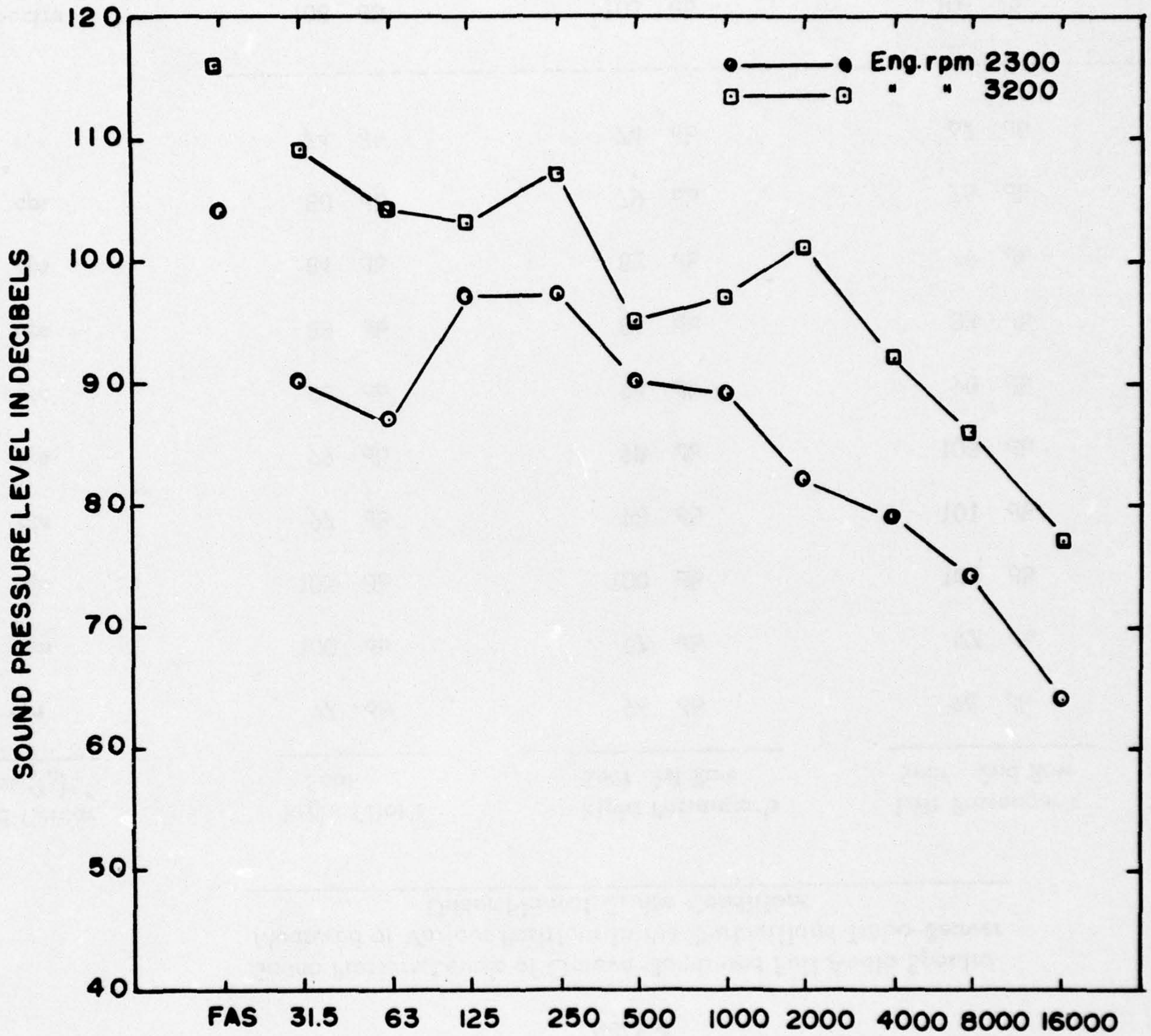
Table 4 shows the sound pressure level values determined from an octave-band analysis of the noise at various positions in the aircraft. The range of variation of sound pressure levels of the full audio spectrum was 4 db. The peak sound pressure level at all positions was in the band with 125 cps center frequency.

Figure 2 shows spectra contours of the U-6A and the Turbo-Beaver. The values of sound pressure levels for the U-6A were taken from USAARU Report No. 64-1. These measurements were made with General Radio octave-band filters whereas the measurements of the Turbo-Beaver were made with Brüel and Kjaer filters. The values of the center frequencies on abscissa are plotted in their true relationship on a logarithmic scale which makes the comparison of the two spectra valid. The values in the Turbo-Beaver spectrum contour were taken from the right ear of the co-pilot. These measurements were considered to be the most comparable, of these available, to the set of the measurements taken at the left ear of the U-6A pilot. Both positions were at ear level and near the side of the aircraft.

TABLE 4

Sound Pressure Levels of Octave-Bands and Full Audio Spectra
Measured at Various Positions in the DeHavilland Turbo-Beaver
Under Normal Cruise Conditions

Octave-Band Center Frequencies (f_c)	Right Pilot's Seat	Right Passenger's Seat 1st Row	Left Passenger's Seat 2nd Row	Rear Passenger's Seat
31.5 cps	97 db	96 db	96 db	98 db
63 cps	100 db	97 db	97 db	99 db
125 cps	105 db	100 db	103 db	101 db
250 cps	97 db	98 db	101 db	98 db
500 cps	99 db	98 db	103 db	92 db
1000 cps	96 db	96 db	90 db	84 db
2000 cps	88 db	86 db	83 db	78 db
4000 cps	84 db	82 db	79 db	74 db
8000 cps	80 db	79 db	75 db	69 db
16000 cps	74 db	74 db	62 db	52 db
Full Audio Spectra	108 db	105 db	106 db	105 db



FULL AUDIO SPECTRUM (FAS) AND CENTER
FREQUENCIES OF OCTAVE BANDS IN CPS

FIGURE 1

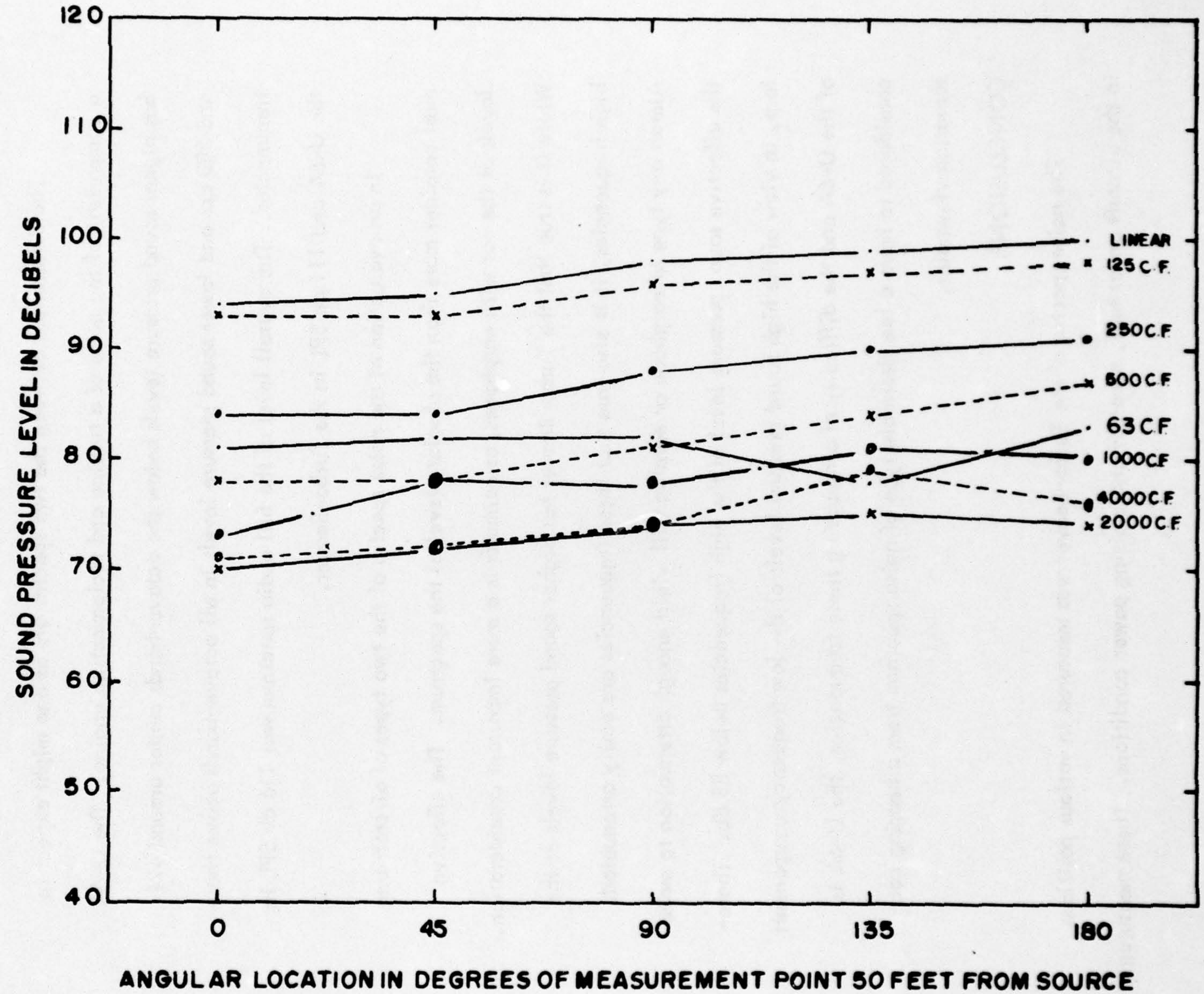

SOUND PRESSURE LEVEL IN DECIBELS
120
110
100
90
80
70
60
50
40
0
45
90
135
180
LINEAR
125 C.F.
250 C.F.
500 C.F.
63 C.F.
1000 C.F.
4000 C.F.
2000 C.F.
ANGULAR LOCATION IN DEGREES OF MEASUREMENT POINT 50 FEET FROM SOURCE

FIGURE 2

The differences between the two spectra are as one might expect in a comparison of the noise of a turbine and reciprocating engine. The U-6A has higher sound pressure levels below the octave-bands center around 424 and 500 cps and lower sound pressure levels in all octave-bands above these frequencies. The overall level of the full audio spectrum was 116 db SPL in the U-6A and 111 db SPL in the Turbo-Beaver.

In an evaluation of the noise spectra of the two types of aircraft one must consider more than the absolute level of the spectrum. The effective levels at the ear with earphones, or earmuffs is a more important consideration. While it is true that the Turbo-Beaver has higher sound pressure levels at the high frequencies, it is also true that these frequencies are easily attenuated. Almost any type of earphone or earplug will yield enough attenuation to make the effective sound pressure level of the high frequencies below 85 db. Therefore, in view of the high sound pressure levels of the low frequency components of the U-6A and the difficulty of attenuating these frequencies, the U-6A is considered to have a less desirable type of noise spectrum from a hearing conservation viewpoint.

CONCLUSIONS:

The noise spectra of the Turbo-Beaver was measured in various positions in the aircraft under taxi, take-off and cruising power conditions. These measurements

were compared with similar measurements taken in the U-6A as was reported in USAARU Report No. 64-1. A comparison of the data collected on these type of aircraft show that the Turbo-Beaver has an overall level of the full audio spectrum 5 db less than the U-6A. Also, the Turbo-Beaver had three octave-bands lower sound pressure levels below the band centered around 424 cps. The U-6A had lower sound pressure levels in the high frequency portion of the spectrum.

In view of the shape of the noise spectra of the two aircraft and the nature of the attenuation characteristics of most earphones, earmuffs and earplugs it is considered that the U-6A has the most undesirable noise spectrum.

The US Army Technical Bulletin TB MED 251 of 25 January 1965 requires that personnel wear ear protection who are subjected to relatively steady broad-band noises of sound pressure levels of 92 db in the 150-300 cps and 85 db at all higher octave-bands through 9600 cps. The sound pressure levels in the Turbo-Beaver and the U-6A are above these levels and therefore require measures be taken for conservation of hearing for both maintenance and operating personnel.

UNITED STATES ARMY
BOARD FOR AVIATION ACCIDENT RESEARCH
Fort Rucker, Alabama

BAAR-I 26 May 1965

SUBJECT: Aviation Safety Evaluation of DeHavilland Turbo-Beaver Aircraft. USATECOM Project No. 4-5-1020-01

TO: President
US Army Aviation Test Board
Fort Rucker, Alabama

1. USABAAR conducted a safety evaluation of the subject aircraft on 13 May 1965.

2. The following items were found to be below minimum safety requirements:

a. Exhaust fumes entered the cockpit and cargo area. These fumes were extremely heavy in the aft cargo area. This is considered very detrimental to crew and passengers.

b. The aircraft is one inch out of the maximum forward C. G. limit when loaded with full fuel and two people in the pilot's compartment. It takes 100 pounds of weight in the aft cargo compartment to offset this unbalance.

c. It is very easy to reverse the propeller in flight. The power quadrant is not designed to prevent this or to furnish adequate awareness to the pilot of impending reversal.

d. The fuel control lever is so designed as to permit inadvertent shut off of the fuel.

e. The engine instrument location is very poor. The engine and propeller tachometers are located on the lower middle panel and are very difficult to read. The instruments are very small and would present quite a problem in reading them during a night emergency.

Incl 6

f. The seats and restraint system are very poor. The seats are tied down to hardpoints in the floor. However, the seat itself was made of tubular steel with stress concentrations at the tie-down point. Seat belts were attached to the seats. The entire restraint system was far below minimum crashworthiness requirements.

4. It is recommended that all of the above items be corrected prior to obtaining this type aircraft for the Army inventory.

/s/ Robert M. Hamilton
/t/ ROBERT M. HAMILTON
Colonel, Inf
Director

C O P Y

DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. ARMY TEST AND EVALUATION COMMAND
Aberdeen Proving Ground, Maryland 21005

AMSTE-BG 12 Aug 1965

SUBJECT: Letter Test Report, Military Potential Test of the Turbine-Powered U-6 Airplane, USATECOM Project No. 4-5-1020-01

TO: Commanding General, U.S. Army Materiel Command, ATTN: AMCRD-D, Washington, D.C. 20315
Commanding General, U.S. Army Combat Developments Command, ATTN: CDC LnO USATECOM, Aberdeen Proving Ground, Maryland 21005

1. The subject test report, incl 1, is forwarded for comments and concurrence.

2. This command concurs with the conclusion and recommendation contained in the subject report.

3. Distribution of the report in accordance with the list inclosed with the test directive has been directed with the exception that copies were not furnished to foreign offices or foreign liaison officers.

FOR THE COMMANDER:

OLIVER H. ASPINWALL, JR.
Capt, AGC
Asst Admin Officer

1 Incl
as
(AMC - 5 cys)
(CDC - 11 cys)

Copies furnished:
(see page 2)

C O P Y

AMSTE-BG
SUBJECT: Letter Test Report, Military Potential Test of the Turbine-Powered U-6 Airplane, USATECOM Project No. 4-5-1020-01

Copies furnished (continued):
Pres, USAATB
w/o Incl
CO, USAATA
w/o Incl